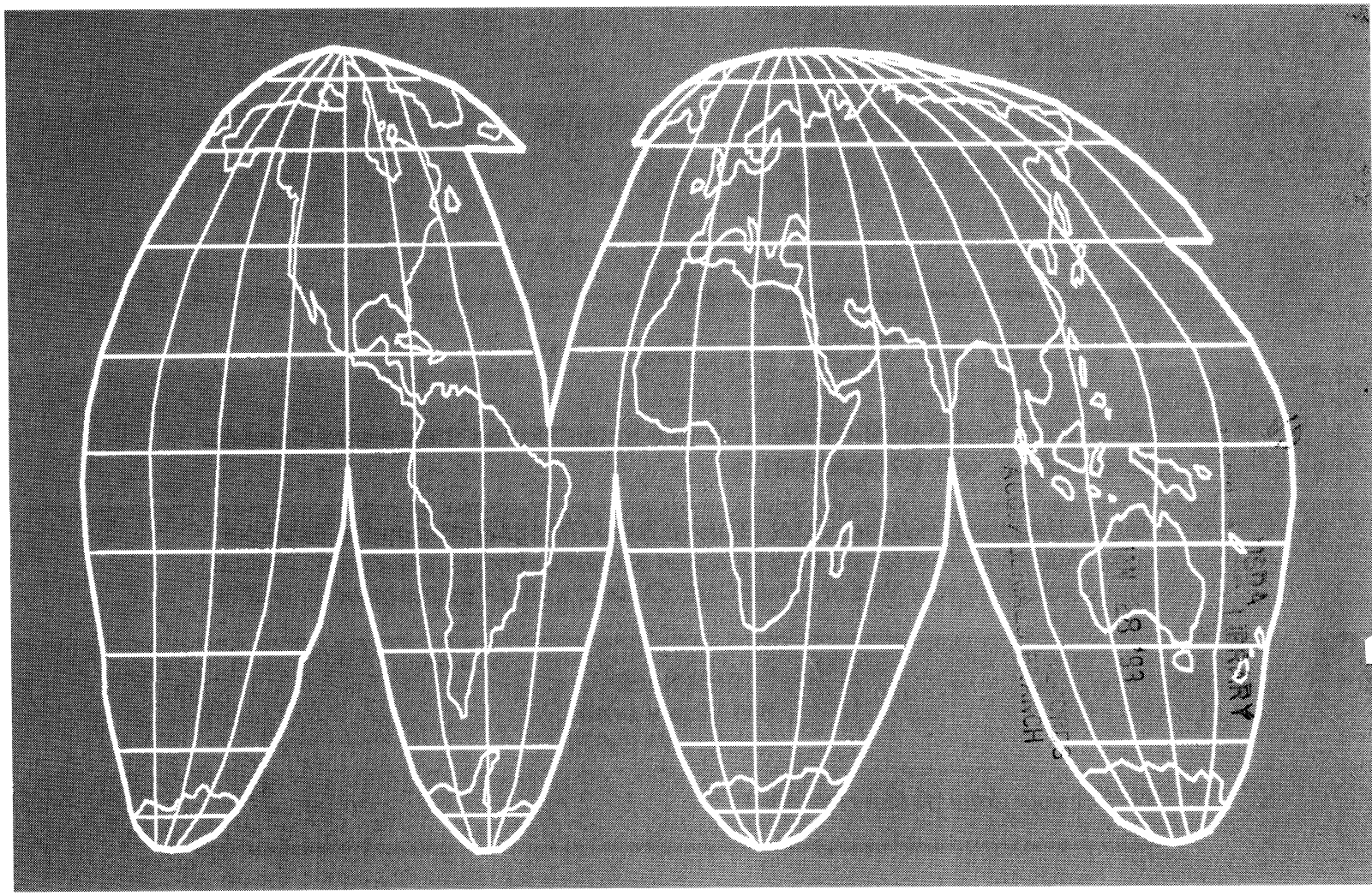
United States
Department of
Agriculture

Economic
Research
Service

Technical
Bulletin
Number 1812

Diagnostic Indexes of U.S. Bilateral Trade

Thomas L. Vollrath



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Diagnostic Indexes of U.S. Bilateral Trade. By Thomas L. Vollrath. Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture. Technical Bulletin No. 1812.

Abstract

Using information contained in merchandise trade records, the author calculates measures of bilateral trade intensity that indicate the extent to which the United States penetrates specific import markets and the penetration of U.S. markets by foreign suppliers. Derivative statistics include indicators that measure the complementarity influence of U.S. and partner trade based on the composition of their trade with the world. Other derivative statistics are measures of overall-special-nation bias that incorporate such sphere-of-influence determinants as differential transportation costs, discriminatory trade barriers, cultural ties, and special trading arrangements. These various indexes can be used to help examine ex post the outcome of global free trade and preferential trading agreements.

Keywords: United States, bilateral trade, competitiveness, complementarity, U.N. trade data.

Acknowledgments

The author thanks Paul Johnston, Jerry Sharples, John Dunmore, Ed Overton, David Stallings, Barry Krissoff, Gene Mathia, John Dyck, and Francis Urban for insightful critiques. He also thanks Lindsay Mann for editorial assistance, Linda Scott for help manipulating the data, Sam Calhoun for assistance with graphics software packages, and Diane Marshall, Lisha Mason, and Wynette Phillips for preparing the manuscript for desk-top publishing.

Washington, DC 20005-4788 December 1992

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Thomas L. Vollrath

Introduction

One can use different diagnostic instruments to identify basic economic relationships between any two countries and to assess the evolving structure of their trade. In this report, I investigate analytical tools that exploit information contained in public trade records and show theoretical linkages among those tools. The approach involves calculation of various trade indexes that measure the extent to which one country is able to penetrate the other's market and the nature of bilateral complementarity as determined by the commodity composition of world trade. The United States and trade in all merchandise provide the focus of my empirical applications. A current lack of reliable data precludes a detailed application to agriculture.

Brown was interested in depicting the anatomy of world trade beyond simple market shares (3).[1] He noted that differences in the size of the U.S. and Costa Rican markets largely explained why Britain traded more with the former than with the latter. But this explanation was "too obvious to be interesting" (3, p. 214). He devised a bilateral-trade-intensity index that provided additional insight.[2] His index, $BI(1)$, is defined as follows:

$$BI(1)^{ij} = \frac{X^{ij}}{X^{iw}} \Big/ \frac{M^{jw}}{M^{ww} - M^{iw}}, \quad i \neq j \qquad \textbf{(1)}$$

where X refers to exports, M to imports, and superscripts i, j, and w denote an exporter, an importer, and the world.[3]

Kunimoto provides an "intuitive interpretation" for the bilateral-trade-intensity index (10). He contends that this index distinguishes impediments and inducements that bear upon the geographical distribution of commerce among countries from those that influence levels of bilateral trade. Typical impediments and inducements include discriminatory trade barriers, relative distance, historical, cultural, and political affinities, the similarity or dissimilarity of commodity composition of trade, and so forth. According to Yamazawa, the level

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[1]Underscored numbers in parentheses identify literature listed in the References section.

[2]One implication Brown drew from his early appraisal of world trade was that human needs are often best satisfied by ignoring the issue of bilateral balancing of trade (3, p. 226). This observation has contemporary relevance because of concerns, repeatedly expressed in the public media, about U.S. trade deficits with Japan and the Republic of Korea.

[3]The value of bilateral trade intensity is always greater than or equal to zero. Zero identifies no market penetration whatsoever.

of two countries' trade with each other is proportional to their gross national products (GNP's) (17).

The concept of bilateral trade intensity has provided other researchers with a focal point for analyses of how trade liberalization and increased interdependence among countries have affected trade patterns. For example, Yamazawa used a bilateral-trade-intensity index to study structural change (17). He recognized that economists should be more concerned with the pattern of a country's exports to or imports from the world than with its trade with particular partners. However, he believed that the structure of bilateral trade also merited investigation because changes in trade between two countries affect their trading arrangements with the world.

Yamazawa streamlined the bilateral-trade-intensity measure so that it could be used to clarify basic relationships among various indexes found in the trade literature. His simplified bilateral-trade-intensity measure, $BI(2)$, is defined as follows:[4]

$$BI(2)^{ij} = \frac{X^{ij}}{X^{iw}} \Big/ \frac{M^{jw}}{M^{ww}}. \qquad (2)$$

In this manuscript, all empirical measures are based on Brown's original formula using reconciled data that have been adjusted to eliminate discrepancies between reported exports and imports. Brown's $BI(1)$ and derivative indexes eliminate double counting and are advantageous when the focus is on a large country like the United States. However, the conceptual structure of Yamazawa's simplified index, $BI(2)$, and the statistics derived from it are presented to enrich economic discussion and aid interpretation. $BI(2)$ and related measures render transparent theoretical linkages among bilateral trade intensity, trading partner complementarity, and global comparative advantage.

The Two Sides to Bilateral Trade Intensity

$BI(.)^{ij}$ measures market penetration within the context of country i as an exporter, country j as an importer, and overall world trade. $BI(2)^{ij}$ directly varies with the importance of exporter i as a supplier to importer j (X^{ij}/M^{jw})[5] and the significance of the particular

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[4]Trade-weighted averages of BI over all of an exporter's trading partners equal unity. For such equalities to hold, the following weights (w^j_{BI}) for $BI(1)$ and $BI(2)$ must be used:

$$w^j_{BI1} = \frac{T^{jw}}{(T^{ww} - T^{iw})} \; ; \; w^j_{BI2} = \frac{T^{jw}}{T^{ww}} \, ,$$

where T refers either to exports or imports.

[5]Given the reconciled trade matrix,

$$\frac{X^{ij}}{M^{jw}} = \frac{X^{ij}}{X^{wj}} = \frac{M^{ji}}{M^{jw}} \, .$$

importer in demanding the exporter's products (X^{ij}/X^{iw}). $BI(2)^{ij}$ inversely varies with the importance of the importer in world trade (M^{jw}/M^{ww}) and the importance of the exporter in world trade (X^{iw}/M^{ww}).

Bilateral trade intensity gauges relative market penetration. Should $BI(2)^{ij}$ equal one, exporter i's penetration of market j is the same as the average of all exporters' penetration in country j ($X^{ij}/X^{iw} = M^{jw}/M^{ww}$).[6] A $BI(2)^{ij}$ value greater than one shows that country i is doing better than average in exporting to j's market. The converse is also true.

One must, however, remember that trade is a two-way street. Countries export to and import from each other and the rest of the world. To achieve a balanced summary of trade between two countries, one must supplement $BI(.)^{ij}$ with its counterpart image, namely $BI(.)^{ji}$. $BI(.)^{ji}$ reverses the roles played by countries j and i, treating the former as the exporter and the latter as the importer. $BI(.)^{ji}$ measures exporter j's penetration of i's market within the framework of country i's importance as a world consumer $[(X^{ji}/X^{jw})/(M^{iw}/M^{ww})]$. $BI(.)^{ji}$ can also be described as gauging the importance of j in providing i with foreign goods within the framework of j's importance as a supplier of goods in the world market $[(M^{ij}/M^{iw})/(X^{jw}/X^{ww})]$.

Examples may facilitate interpretation. In table 1, I compare four Yamazawa-type bilateral-trade-intensity measures: one with the United States (US) as an exporter and Brazil (BR) as an importer, another with the United States again as an exporter but the European Community (EC) as an importer, a third with Brazil as an exporter and the United States as an importer, and a fourth with the United States again as an importer and the EC as an exporter.

In 1986, $BI(2)^{US,BR}$ was 2.21, $BI(2)^{US,EC}$ was 0.65, $BI(2)^{BR,US}$ was 1.52, and $BI(2)^{EC,US}$ was 0.57. These results show that U.S. exporters were better able to gain entry into the Brazilian and EC import markets than exporters in Brazil and the EC were able to capture the U.S. import

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[6] A unitary bilateral-trade-intensity index also demonstrates that there is no difference in the importance of country i in supplying imports to j than its importance in supplying imports to the world ($X^{ij}/X^{wj} = X^{iw}/X^{ww}$; or $X^{ij}/M^{jw} = X^{iw}/M^{ww}$).

Table 1--Bilateral-trade-intensity index and its principal components, 1986

Exporter i	Importer j	X^{ij}/X^{iw}	X^{ij}/M^{jw}	X^{iw}/M^{ww}	X^{iw}/M^{ww}	$BI(2)^{ij}$
		Percent				Index
United States	Brazil	1.8	24.9	0.8	11.3	2.21
United States	EC	23.0	7.4	35.2	11.3	.65
Brazil	United States	25.4	2.0	16.8	1.3	1.52
EC	United States	9.6	20.9	16.8	36.5	.57

market; that is, $BI(2)^{US,BR} > BI(2)^{BR,US}$ and $BI(2)^{US,EC} > BI(2)^{EC,US}$ (table 1).

If we focus on the United States as an exporter and Brazil and the EC as importers, the figures in the upper half of the table demonstrate that the United States was more successful penetrating the Brazilian market than the EC market, $BI(2)^{US,BR} > BI(2)^{US,EC}$. This penetration took place despite the fact that the share of total U.S. exports going to the EC (23.0 percent) was 12.8 times greater than the share of total U.S. exports going to Brazil (1.8 percent). Penetration was successful because the United States was 3.36 times more important as a supplier of Brazil's import needs than as a supplier of EC's import demands; that is, 25 percent of Brazil's imports came from the United States, but only 7 percent of EC imports came from the United States. The EC was 44 times as important in absorbing world imports as Brazil was; that is, Brazil's share of the world import market was less than 1 percent, while the EC's share exceeded 35 percent.

Bilateral Trade Complementarity, Economic Specialization, and Global Comparative Advantage

The inability of bilateral-trade-intensity indexes to allow for the various product mixes typifying countries' foreign trade concerned Drysdale (4, 5). He noted that the opportunities for two countries to trade with each other are affected by the composition of one country's exports and the other's imports. Drysdale addressed this problem by decomposing $BI(1)$ into the product of two measures: $CC(1)$, a "commodity bias" or complementarity component, and $SN(1)$, a "special-country bias" or overall-special-nation component. The complementarity component is based on the disaggregated commodity architecture embodied within the bilateral-trade-intensity index. The overall-special-nation component measures bilateral resistances affecting the general nature of two countries' trade.

Drysdale's measure of complementarity is defined as follows:

$$CC(1)^{ij} = \sum_{a=1}^{n} \left[\frac{X_a^{iw}}{X_t^{iw}} \times \frac{(M_t^{ww} - M_t^{iw})}{(M_a^{ww} - M_a^{iw})} \times \frac{M_a^{jw}}{M_t^{jw}} \right] \quad (3)$$

where a refers to a specific commodity and t to all traded commodities.

Yamazawa (17) showed that $CC(2)$, the commodity-bias index derived from $BI(2)$, is obtained by replacing the actual value of total bilateral trade by its expected value:

$$CC(2)^{ij} = \frac{E(X_t^{ij})}{X_t^{iw}} \Big/ \frac{M_t^{jw}}{M_t^{ww}} . \quad (4)$$

The expected value of total exports from i to j is equal to country i exporting goods to country j in accordance with the latter's import share for each commodity in the world market. $CC(2)$ may also be viewed

as equal to j importing goods from i in accordance with the latter's export share for each commodity in the world market.[7]

The commodity-bias index measures the extent to which the commodity composition of one nation's exports matches the commodity composition of another's imports. A reformulation of $CC(2)$ clarifies this pairing:[8]

$$CC(2)^{ij} = \sum_{a=1}^{n} \left[\frac{T_a^{ww}}{T_t^{ww}} \times RXS_a^{iw} \times RMS_a^{jw} \right], \text{ where} \tag{5}$$

$$RXS_a^{iw} = \frac{X_a^{iw}}{X_a^{ww}} \Big/ \frac{X_t^{iw}}{X_t^{ww}} \text{ and} \tag{6}$$

$$RMS_a^{jw} = \frac{M_a^{jw}}{M_a^{ww}} \Big/ \frac{M_t^{jw}}{M_t^{ww}}. \tag{7}$$

In equation (5), T refers to total trade, measured either in terms of exports or imports.

Equation (5) shows that $CC(2)$ is the trade-weighted product of i's relative export market share for good a (RXS_a^{iw}) and its partner j's relative import market share for good a (RMS_a^{jw}), summed across all commodities. The RXS^i commodity profile reflects country i's pattern

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[7]In symbolic terms, the expected value of total exports from i to j can be expressed in the following ways:

$$E(X_t^{ij}) = \sum_{a=1}^{n} E(X_a^{ij}) = \sum_{a=1}^{n} \left(X_a^{iw} \times \frac{M_a^{jw}}{M_a^{ww}} \right) = \sum_{a=1}^{n} \left(M_a^{jw} \times \frac{X_a^{iw}}{X_a^{ww}} \right).$$

[8]Alternative formulations of CC(2) include the following:

$$CC(2)^{ij} = \frac{\sum_{a=1}^{n} E(X_a^{ij})}{X_t^{iw}} \Big/ \frac{M_t^{jw}}{M_t^{ww}},$$

$$CC(2)^{ij} = \sum_{a=1}^{n} \left[\frac{X_a^{iw}}{X_t^{iw}} \times \frac{M_a^{jw}}{M_a^{ww}} \times \frac{M_t^{ww}}{M_t^{jw}} \right], \text{ and}$$

$$CC(2)^{ij} = \sum_{a=1}^{n} \left[\left(\frac{X_a^{iw}}{X_t^{iw}} \Big/ \frac{M_a^{ww}}{M_t^{ww}} \right) \times \left(\frac{M_a^{jw}}{M_t^{jw}} \Big/ \frac{M_a^{ww}}{M_t^{ww}} \right) \times \left(\frac{M_a^{ww}}{M_t^{ww}} \right) \right].$$

of relative export specialization. The RMS^j commodity profile similarly reflects country j's relative-import-specialization pattern.

One economic interpretation of $CC(.)^{ij}$ is that it gauges complementarity between two trading partners based on their commodity-trade-specialization patterns. One should recognize that using $CC(.)$ to make inferences about the extent of bilateral trade complementarity is affected by the level of commodity aggregation. Because market niches exist within composite commodity categories, bilateral trade complementarity would best be revealed using a highly disaggregated and inclusive commodity database.

When country i specializes in the export of commodities that country j intensively imports, both countries' economic structures become reinforcing or compatible. Complementarity is strong when $CC(.)$ is greater than one. Complementarity is weak when $CC(.)$ is less than one.

RXS_a^{iw} measures relative export shares and RMS_a^{jw} measures relative import shares. Relative trade shares are determined not only by global comparative advantage but also by government actions related to the creation of tariff and nontariff barriers and the formation of macro policies. $CC(.)$, being the sum of a trade-weighted product of RXS^i and RMS^j, is related to global comparative advantage.

Elsewhere (15), I have shown that a positive (negative) departure of i's actual exports of commodity a to the world from the expected level approximates comparative advantage (comparative disadvantage), in a world free from discriminatory distortions caused by government intervention and market failure.[9] Comparative disadvantage (comparative advantage) is revealed when j's actual imports from the world exceed (fall short of) its expected level.[10]

In the absence of discriminatory distortions, RXS_a^{iw} and RMS_a^{jw} depict two dimensions of comparative advantage, relative export supply for country i and relative import demand for country j. RXS_a^{iw} is equivalent to Balassa's widely used measure of "revealed comparative advantage" for commodity a and country i. RMS_a^{jw} is similar in construction but

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[9]This association is made apparent by decomposing RXS_a^{iw} and RMS_a^{jw} into ratios of actual-to-expected commodity trade:

$$RXS_a^{iw} = \frac{X_a^{iw}}{E(X_a^{iw})}, \text{ where } E(X_a^{iw}) = X_t^{iw} \times \frac{X_a^{ww}}{X_t^{ww}} \text{ and}$$

$$RMS_a^{jw} = \frac{M_a^{jw}}{E(M_a^{jw})}, \text{ where } E(M_a^{jw}) = M_t^{jw} \times \frac{M_a^{ww}}{M_t^{ww}}.$$

Comparative advantage is approximated when $X_a^{iw}/E(X_a^{iw}) > 1$ and/or $M_a^{jw}/E(M_a^{jw}) < 1$. Comparative disadvantage is approximated when $X_a^{iw}/E(X_a^{iw}) < 1$ and/or $M_a^{jw}/E(M_a^{jw}) > 1$.

[10]$RXS_a^{iw} > 1$ and $RMS_a^{iw} < 1$ are proxy measures of comparative advantage, and $RXS_a^{iw} < 1$ and $RMS_a^{iw} > 1$ approximate comparative disadvantages.

emphasizes relative import behavior for country j rather than relative export behavior for country i.

To the extent that RXS_a^{iw} and RMS_a^{jw} accurately reflect global comparative advantages, a second economic interpretation of $CC(.)^{ij}$ is that it identifies complementarity in terms of the degree to which country i's comparative-advantage profile conforms with country j's comparative-disadvantage profile.[11]

Complementarity is strengthened whenever exporter i has a comparative advantage in a commodity in which importer j has a comparative disadvantage.[12] Complementarity is weakened whenever both exporter i and importer j have comparative advantages in identical commodities and when both the exporter and the importer have comparative disadvantages in the same commodities.

Bilateral Trade Resistance and the Special-Country Bias

Trading bloc membership and differences in economic systems are examples of market resistances that prevent commodity movements from responding to changing world price signals. Other examples of market resistances include differential transportation costs and discriminatory import tariffs and quotas. Drysdale's measure of country bias for each traded commodity, called "the special-nation-bias index for commodity a" ($SN(1)_a^{ij}$), purportedly embodies these kinds of resistances. His index is defined as follows:

$$SN(1)_a^{ij} = \frac{X_a^{ij}}{X_a^{iw}} \Big/ \frac{M_a^{jw}}{M_a^{ww} - M_a^{iw}}. \qquad (8)$$

The $SN(1)_a$ measure is analogously constructed to the bilateral-trade-intensity index, but with attention focused at the disaggregated commodity level. $SN(1)_a$ measures the extent to which country i's export penetration for commodity a in country j differs from other commodity-a exporters' access to j's import market. $SN(1)_a^{ij}$'s are

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[11]To see how the structure of global comparative advantage typifying exporting and importing nations across the commodity spectrum relates to the commodity-bias index, we can express $CC(2)$ in yet another way:

$$CC(2)^{ij} = \sum_a^n \left[\frac{T_a^{ww}}{T_t^{ww}} \times \frac{X_a^{iw}}{E(X_a^{iw})} \times \frac{M_a^{jw}}{E(M_a^{jw})} \right].$$

This equation shows that $CC(2)$ is the sum of the trade-weighted product of country i's exports of each commodity divided by its expected value in a neutral-comparative-advantage-export world times country j's actual imports for each corresponding commodity divided by its expected value in a neutral-comparative-advantage-import world. The economic interpretation is that $CC(2)$ measures the extent to which i's export pattern and j's import pattern conform to their estimated global comparative advantages across all commodities.

[12]Complementarity is also enhanced whenever exporter i has a comparative disadvantage in a commodity for which importer j has a comparative advantage.

likely to vary in magnitude across commodities. For example, the effect of relative distance as a resistant factor is likely to be stronger for fresh fruits and vegetables than for less perishable food and feed grains.

Moving his analysis from the individual commodity level to the economy as a whole, Drysdale defines $SN(1)$, an index of "overall-special-nation bias," as follows:

$$SN(1)^{ij} = \frac{X_t^{ij}}{\sum_a^n \left(X_a^{iw} \times \frac{M_a^{jw}}{M_a^{ww} - M_a^{iw}} \right)}. \tag{9}$$

Yamazawa (17) shows that $SN(2)$ is the ratio of actual-to-expected bilateral trade:

$$SN(2)^{ij} = \frac{X_t^{ij}}{E(X_t^{ij})}. \tag{10}$$

$SN(.)$ measures the average effect on a country's exports to another nation of resistances to the functioning of free, open, and perfect markets where transactions take place both instantaneously and without costs as in neoclassical theory. Obstacles such as differential transportation costs, targeted quotas, discriminatory trade barriers, cultural ties, imperfect competition, and special trading arrangements inhibit international commodity flows in response to global price signals. These resistances cause prices to vary from one country to another and bear upon the direction and, hence, the geographical distribution of world trade. In the absence of discriminatory government activity, $SN(.)$ measures the presence of factors which influence geographical specialization of commodity trade between two countries outside of that occurring as a result of their global comparative advantages.

Applications Found in the Literature

Although many economists have used $BI(.)$ and $SN_a(.)$ in empirical analyses, few have incorporated Drysdale's commodity-bias and overall-special-nation-bias indexes, presumably because of stringent data requirements. However, Anderson and Garnaut used $BI(1)$, $CC(1)$, and $SN(1)$ to examine the theory of dynamic comparative advantage and Australia's high propensity to trade with developing countries in East Asia and the Middle East (2). In another study, Anderson used $CC(1)$ to examine the extent of complementarity among four groups in the Pacific Basin (Australasia, Japan, Asian newly industrialized countries (NIC's), and other countries of the Association of South East Asian Nations) at four levels of trade aggregation: total merchandise,

agriculture, manufacturing, and fuels, minerals, and metals (1).[13] Yamazawa extended his earlier analysis of world trade flows by empirically identifying the extent to which $BI(2)$ was affected by basic determinants, including complementarity of two countries' trade as measured by $CC(2)$(16).[14]

A Glimpse of U.S. Bilateral Competitiveness

The importance of the United States in supplying goods to specific import markets can easily be identified using the bilateral-trade-intensity index. A positive deviation of $BI^{US,j}$ from one indicates a stronger than average penetration by the United States, typifying supplier penetration or U.S. bilateral competitiveness in the specified import market. A negative $BI^{US,j}$ deviation from one manifests a weaker than average competitive presence. Strong bilateral relationships are due to complementarity in the commodity composition of each trading partner's world trading patterns and/or to positive influences of such specific-nation characteristics as special trading arrangements, geographic proximity, and close cultural or political ties.

Figure 1 shows changing patterns of U.S. bilateral competitiveness with France (FR), Iran (IR), Japan (JP), and the former U.S.S.R. (SU) using unexpurgated United Nations data for 1962-85. The United States has consistently been an important source of imports in the Japanese market ($BI^{US,JP} > 1$). By contrast, the United States has not been particularly important in the French market ($BI^{US,FR} < 1$). Weak U.S. penetration in France is attributable, in part, to the fact that the French trade disproportionately with their immediate neighbors because of common membership in the EC. But, complementarity in U.S. and French global commodity trade is also weak, as shown by $CC^{US,FR} < 1$ in figure 2.

The effect that special-nation characteristics can have in shaping market penetration is demonstrated in the case of U.S.-Iranian trade. The United States displayed a strong export presence in Iran until 1979 ($BI^{US,IR} > 1$). Then U.S. exports fell dramatically because of the Iranian revolution. U.S. penetration was weak thereafter ($BI^{US,IR} < 1$). The shift from strong to weak penetration was created by geopolitical events and the collapse of U.S.-Iranian diplomatic relations rather than by fundamental changes in the commodity composition of trade characterizing U.S. export and Iranian import trade with the world. $CC^{US,IR}$ exceeded one throughout 1962-85.

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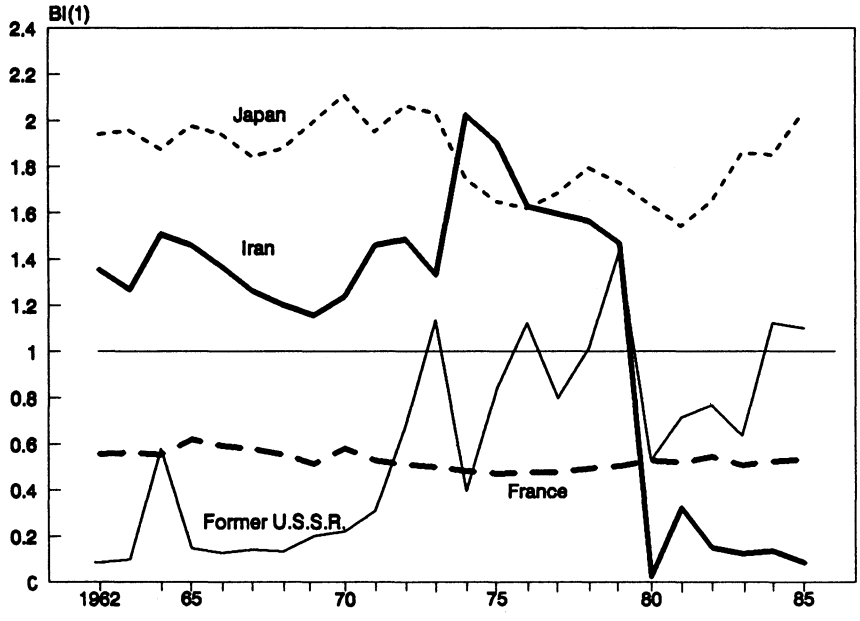
[13]Anderson expressed surprise at not finding strong complementarities typifying trade within the Pacific Basin. The explanation given for the empirical results was "that most countries have erected substantial barriers on numerous products in which they have a strong comparative advantage." Japan and the Republic of Korea were cited as examples of countries having import barriers for both food and primary processing of ores and concentrates. Australasia was identified as having barriers that artificially lowered imports of labor-intensive manufactured goods.

[14]Yamazawa found that the elasticity of $CC(2)$ with respect to $BI(2)$ consistently fell within the elastic zone. He also found that the influence of two $SN(2)$ determinants, traditional trading blocs and different economic systems (capitalist versus socialist), declined between 1955-57 and 1965-67. Both of these findings underscore the importance of fundamental market supply and demand forces in shaping world trade.

Figure 1

Bilateral trade intensity with the United States as exporter and France, Iran, Japan, and the former U.S.S.R. as importers

U.S. penetration of import markets varies across countries and through time

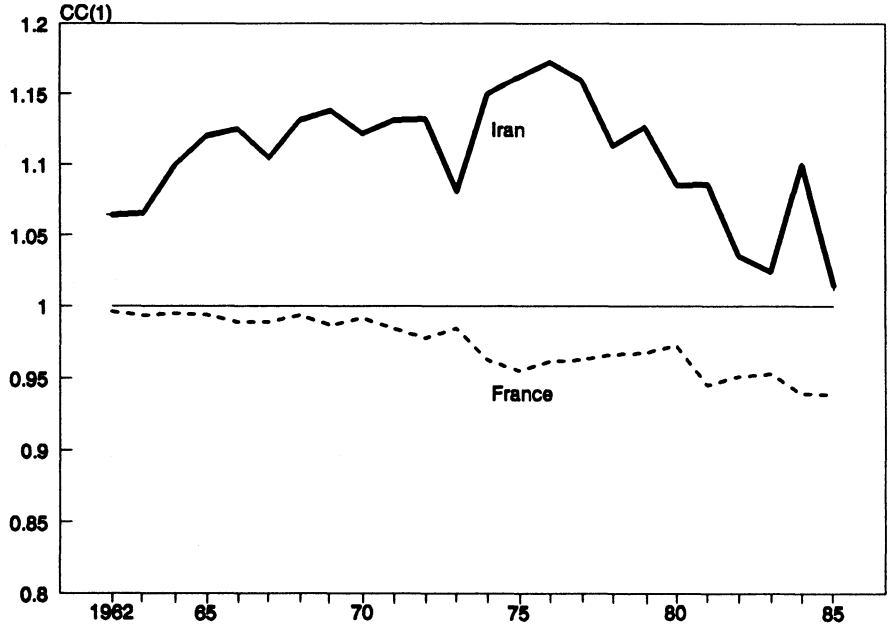


BI(1) > 1: Strong U.S. exporter presence in importer market.
BI(1) < 1: Weak U.S. exporter presence in importer market.

Figure 2

U.S. exporting and Iranian and French importing complementarities

The structure of commodity composition reveals that Iranian imports complement U.S. exports more than do French imports



CC(1) > 1: Strong complementarities
CC(1) < 1: Weak complementarities

The significance of the United States as a supplier of imports to the former U.S.S.R. (SU) has been quite erratic. The United States was less successful than other countries in exporting to the former U.S.S.R. before the early to mid-1970's. The 1963 blip in $BI^{US,SU}$ reflects the first major U.S. wheat sale to the Soviets. Thereafter, the importance of the United States as a supplier of goods to the former U.S.S.R. fluctuated largely in response to changing conditions in Soviet agriculture, until 1980 when the United States imposed a trade embargo after the Soviet invasion of Afghanistan. The mid-1980's marked the return to a better than average economic relationship, illustrated by $BI^{US,SU} > 1$ in 1984 and 1985.

A Corrected Bilateral Trade Database

A database that is all inclusive in terms of commodity and country coverage is needed to calculate the set of bilateral-trade indexes: *BI*(.), *CC*(.), and *SN*(.). One product of a 1990 cooperative agreement between the Economic Research Service and Purdue University was the creation of such a database. A distinguishing feature of this effort is that the U.N.-reported source-destination trade flows for 1986 were adjusted for transportation and insurance margins and for systematic biases attributable to both under- and overreporting in the various economic sectors among each of 19 nations. Adjustments were based on econometric estimations that simulated the data collection process, generating a single transaction matrix whereby $X_a^{ij} = M_a^{ji}$ (8, 14).

The "corrected" database is comprehensive both in terms of commodity and nation coverage. Its attention is directed toward eight economic sectors of the global economy and eight countries [Australia (AU), Brazil (BR), Canada (CA), Japan (JP), Mexico (MX), New Zealand (NZ), former U.S.S.R. (SU), and the United States (US)] and 11 regions [the European Community (EC), other Western Europe and South Africa (OWE), central Europe (CE), other Latin America (OLA), Sub-Saharan Africa (SUB), Middle East and North Africa (ME), old Asian NIC's (OLD), new Asian NIC's (NEW), South Asia (SAS), other Southeast Asia (OSA), and planned Asia (PLA)]. (See the appendix of this report for the composition of these regions.)

U.N. export and import trade data provided the raw material. Total merchandise trade was divided into three natural-resource-based sectors and five manufactured-product sectors. The natural-resource-based sector includes the food and agricultural product industry, forestry and fisheries products, and commodities based on mining and resource extraction. The manufactured-product sector includes a basic intermediates category consisting of capital-intensive products such as primary metals and electricity used in the further manufacture of other goods. Other manufactured-product subsectors include light industries consisting of unskilled-labor-intensive products such as leather goods and clothing, high tech commodities requiring knowledge-intensive resources such as scientific equipment, intermediate manufacturing such as office supplies, printing, and publishing, and such finished capital goods as motor vehicles.

A More Detailed Probing into the Nature of U.S. Bilateral Trade

The U.S.-export, partner-import profile is illustrated in figure 3. The $BI^{US,j}$ distribution shows the ability of the United States to penetrate various import markets compared with other suppliers. $SN^{US,j}$ and $CC^{US,j}$ help explain the nature of U.S. market penetration.

The partner-export, U.S.-import profile is pictured in figure 4. $BI^{j,US}$ depicts the distribution of j's exports' competitive presence in the United States and shows the importance of the different foreign suppliers in providing imports to the United States. $SN^{j,US}$ and $CC^{j,US}$ help explain the penetrations of the U.S. import market.

The prominence of the United States (US) as a supplier of goods in various import markets and the importance of foreign suppliers to the U.S. market underscore the significance of U.S. trade with its North American neighbors, even before the establishment of any free trade area. Mexico (MX) and Canada (CA) are comparatively important to the U.S. import market as $BI^{CA,US}$ and $BI^{MX,US}$ equal 4.2 and 4.1. The United States is also a relatively important supplier to both Canada and Mexico: $BI^{US,CA}$ and $BI^{US,MX}$ equal 5.0 and 5.4.

The prominence of the United States as a supplier of imported goods reveals that U.S. export penetration is also prominent in other Latin America (OLA) and Brazil (BR). Japan (JP), New Zealand (NZ), and Australia (AU) follow the nations in North and South America as heavily relying on the United States to provide their trade needs. The United States has also been successful in penetrating the dynamic developing-nation economies of the newly industrializing countries (OLD and NEW) and countries in other Southeast Asia (OSA) where economic growth is rapid. By contrast, the United States competes less well, compared with other foreign suppliers, in Western Europe and in the poorest regions of the world. These regions include South Asia (SAS) and Sub-Saharan Africa (SUB); planned Asia (PLA), Central Europe (CE), and the former U.S.S.R. (SU); and the Middle East and North Africa (ME), a region which falls within the European commercial sphere of influence.

Nations that depend on the United States to supply them with needed foreign goods tend to be successful in penetrating the U.S. import market. The Spearman rank correlation coefficient between $BI^{US,j}$ and $BI^{j,US}$ is 0.926, showing that U.S. export penetration among foreign importers and their penetration of the U.S. import market are similar.

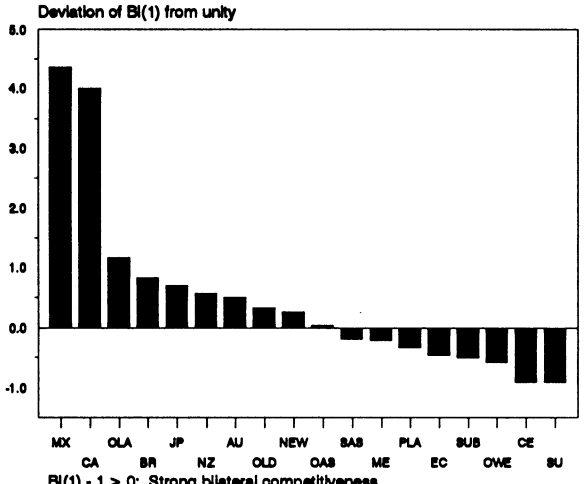
Mutual export-import intensity is not, however, perfectly symmetrical. The United States, as a supplier of foreign goods, is more important to Canada, Mexico, Brazil, and other countries in Latin America than these nations are to the United States. Japan and the combined economies of Taiwan, the Republic of Korea, Hong Kong, and Singapore are more important suppliers to the United States than the United States is a provider to them.

Mutuality in bilateral trade intensity does not strictly hold because of differences in supply and demand structures among nations and because trade between two countries generates monies that are fungible

Figure 3

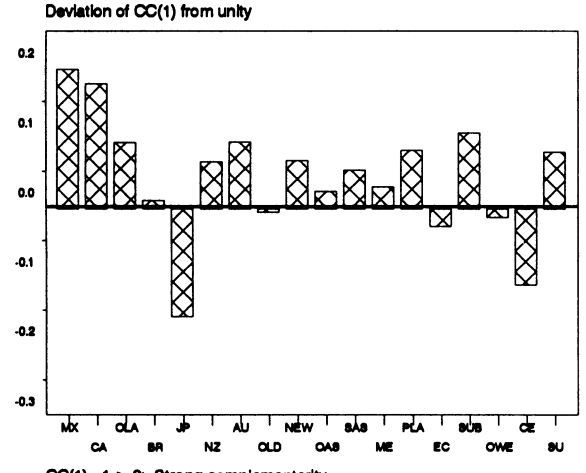
The U.S.-export, partner-import profile

U.S. penetration in partner-import markets show that nations in the Americas and the Pacific Rim are especially important markets for U.S. exports



BI(1) - 1 > 0: Strong bilateral competitiveness
BI(1) - 1 < 0: Weak bilateral competitiveness

Strong complementarities describe most import markets of U.S. exports



CC(1) - 1 > 0: Strong complementarity
CC(1) - 1 < 0: Weak complementarity

Special-nation effects on U.S. exports, partner imports show the importance of sphere-of-influence factors

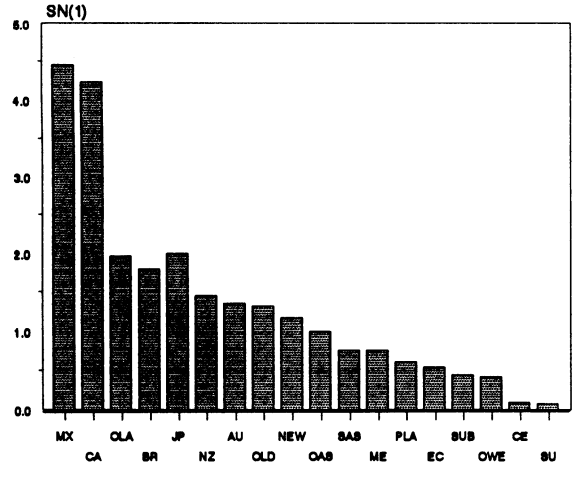
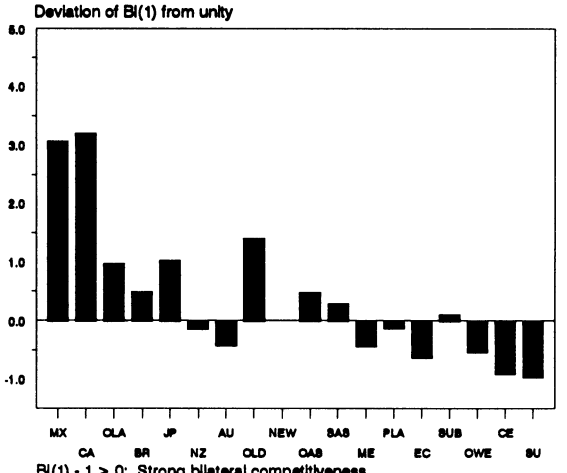


Figure 4

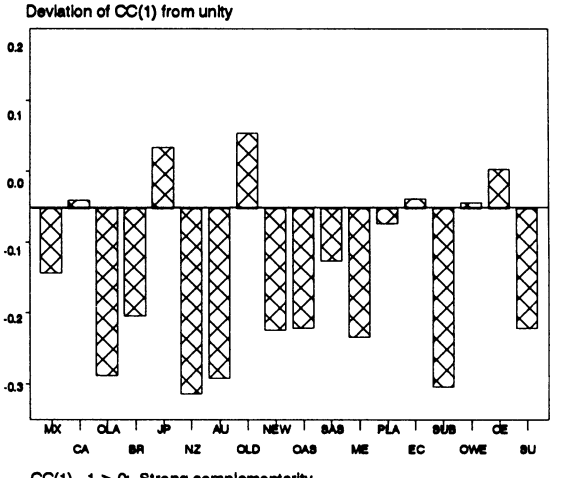
The U.S.-import, partner-export profile

Partner penetrations of the U.S. import market is particularly strong for nations in North and South America and for Japan, Taiwan, South Korea, and Singapore



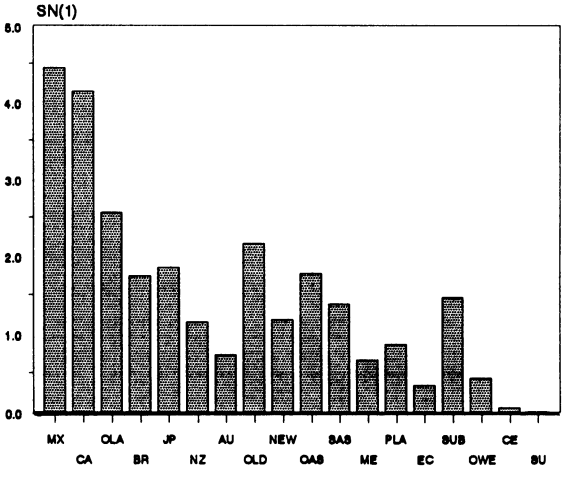
BI(1) - 1 > 0: Strong bilateral competitiveness
BI(1) - 1 < 0: Weak bilateral competitiveness

Weak complementarities describe most exporters supplying the U.S. market



CC(1) - 1 > 0: Strong complementarity
CC(1) - 1 < 0: Weak complementarity

Special-nation effects on partner exports, U.S. imports show the importance of sphere-of-influence factors



on the international markets. Any specified trading partner may be a relatively more important supplier for a specific nation's import needs than that specific nation is to the specified trading-partner importer. For example, my analysis shows that the United States is not a particularly important supplier to Sub-Saharan Africa ($BI^{US,SUB} < 1$). But, the reverse ($BI^{SUB,US} > 1$) does not hold. The United States was half as important in supplying goods to Sub-Saharan Africa as Sub-Saharan Africa was in exporting to the United States ($BI^{SUB,US} \div BI^{US,SUB} = 0.45$). The former U.S.S.R. and Australia, however, were more important markets for the United States than the United States was as an importer of goods from these countries.

Market penetration is influenced by both commodity-bias and special-nation-bias effects. Canada is better than Mexico at penetrating the U.S. market ($BI^{CA,US} > BI^{MX,US}$). The old Asian NIC's are more competitive in the U.S. market than is other Latin America ($BI^{OLD,US} > BI^{OLA,US}$). Yet, Mexico's special-nation-bias effects are larger than Canada's ($SN^{MX,US} > SN^{CA,US}$), and other Latin America's special-nation-bias effects are larger than the old Asian NIC's ($SN^{OLA,US} > SN^{OLD,US}$). The relative success of Canada and the old Asian NIC's is attributable to the close correspondence between their pattern of commodity export specialization and the U.S. pattern of commodity import specialization.

The commodity-bias index can be used to reveal strong and weak bilateral complementarity. Strong complementarities in domestic excess supply and foreign excess demand depict U.S. exports to most nations ($CC^{US,j} > 1$ for most j). Japan and the European Community are notable exceptions. Yet, the United States has successfully penetrated the Japanese market ($BI^{US,JP} > 1$), but not the European Community ($BI^{US,EC} < 1$). Special-nation-bias effects more than compensate for weak complementarity in the Japanese but not the European Community case.

By contrast, most nations exhibit relatively weak bilateral complementarity with respect to the United States ($CC^{j,US} < 1$ for most j). Exceptions include the old Asian NIC's and Japan. Other exceptions include Canada and Europe (EC, OWE, and CE) whose commodity export patterns somewhat match U.S. commodity import patterns, but to a lesser extent than Japan and the old Asian NIC's. All other exporting nations display weak bilateral complementarities.

General Observations

One general observation stemming from the empirical results relates to the importance of neighborliness. U.S. penetration of Mexico's and Canada's import markets and the prominence of Mexican and Canadian exports in the U.S. market suggest that sphere-of-influence factors strongly affect the pattern of bilateral trade.

Relative market penetration is high not only for the United States and both Canada and Mexico, but also between neighbors in most other areas. For instance, bilateral-trade-intensity indexes show that the EC is an important supplier in other Western Europe and Sub-Saharan Africa. Japan has high market penetration in planned Asia, old Asian NIC's, other Southeast Asia, Australia, United States, and New Zealand. All of these Japanese trading partners, except the United States, are

situated in relative close proximity to Japan. The fact that exporter *BI* distributions are skewed in favor of neighboring areas throughout our database furnishes further evidence that transportation cost differentials, preferential trading arrangements, geopolitical considerations, and/or a common cultural and historical heritage are important in explaining bilateral trade.

Another observation derived from the empirical results of our eight-sector, single-year analysis is that the prospects for welfare enhancement appear especially strong with respect to trade between the United States and most developing countries. Weak complementarities characterize the United States as an importer and all developing-nation exporters except the old Asian NIC's. Thin bilateral complementarities are not consistent with the hypothesis stemming from comparative advantage theory whereby countries possessing notable differences in relative factor endowments, such as is the case for the United States and most developing countries, ought to show strong complementarities in their commodity trade. This empirical finding lends support to Ray and Marvel's contention that industrialized countries' trade policies have discriminated against "consumer goods, agricultural manufactures, and textiles, products of particular significance to the developing countries" (11).

Tools To Monitor and Evaluate Policy Change

The Uruguay Round of the General Agreement on Tariffs and Trade (GATT) is an attempt to liberalize world trade. Many countries, including the United States, have initiated bilateral trade negotiations as a means of moving towards more free trade.[15] For example, the Bush administration's "Enterprise for the Americas Initiative" is designed to liberalize commercial relations among countries in North and South America, possibly resulting in the creation of a "Western Hemisphere Free Trade Zone."

U.S. commercial relationships will change in the coming decade. Without a Uruguay Round agreement, preferential trading agreements might proliferate. A splintering of the world economy into well-defined trading blocs could be reflected in increasingly skewed country distributions of the overall-special-nation bias.

With a Uruguay Round agreement, the world economy is likely to become more open, and trade is likely to conform more closely to global comparative advantage given an international consensus to liberalize

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[15]Efforts are underway to establish a North American Free Trade Agreement (NAFTA) involving the United States, Canada, and Mexico. "Framework" agreements have been signed between the United States and Chile, Colombia, Bolivia, and Ecuador. Similar pacts are being considered between the United States and Argentina, Brazil, Uruguay, and Paraguay. Argentina, Brazil, Uruguay, and Paraguay have already created Mercosur, the Southern Cone Common Market. Many in Europe are also encouraging the establishment of free trade geographical areas. Long-range plans envision a "European Economic Area" consisting of nations in both the European Community (EC) and the European Free Trade Association (EFTA). Central European countries want to join this group. They may do so, first as associates and then as bonafide members. The current EC-92 project represents a first step in the direction of implementing pan-European economic integration.

trade in agriculture and services. Enhanced economic complementarity is expected to accompany a Uruguay Round agreement because increased specialization is associated with more open economies.

Monitoring changes in bilateral trade intensity and derivative statistics provide a way to gauge the outcome of whatever agreement may come out of the GATT. Positive consequences of the Uruguay Round would be associated with *CC* increases in most if not all GATT members.

Some countries will probably benefit more than others from trade policy agreements. One country may find, for instance, that its complementarities increase everywhere following a negotiated arrangement. Another may find large increases in complementarities in some, but not all, markets. Examination of changes in bilateral-trade-intensity type indexes, such as *CC*, *BI*, and *SN*, through time could provide useful information about the repercussions of structural change and shifts in both commercial and trade policy.

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Appendix:
Countries and Nations Covered by This Analysis
Using United Nations Trade Data

Individual Countries
Australia
Brazil
Canada
Japan
Mexico
New Zealand
Former U.S.S.R.
United States

European Community
Belgium
Denmark
France
Federal Republic of Germany
Greece
Ireland
Italy
Luxembourg
Netherlands
Portugal
Spain
United Kingdom

Other Western Europe and South Africa
Austria
Faeroe Islands
Finland
Gibraltar
Greenland
Iceland
Norway
Republic of South Africa
Sweden
Switzerland

Central Europe
Albania
Bulgaria
Czechoslovakia
Former German Democratic Republic
Hungary
Poland
Romania
Yugoslavia

Other Latin America
Antigua and Barbuda
Argentina
Bahamas
Barbados
Belize
Bermuda
Bolivia
Chile
Colombia
Costa Rica
Cuba
Dominica
Dominican Republic
Ecuador
El Salvador
Falkland Islands
French Guiana
Grenada
Guadeloupe
Guatemala
Guyana
Haiti
Honduras
Jamaica
Martinique
Montserrat
Netherlands Antilles
Nicaragua
Panama
Paraguay
Peru
St. Kitts-Nevis
Trinidad and Tobago
Uruguay
U.S. Virgin Islands
Venezuela

Middle East and North Africa
Algeria
Bahrain
Cyprus
Egypt
Gaza
Iran
Iraq
Israel
Jordan
Kuwait
Lebanon
Libya
Malta
Morocco
Oman
Qatar
Saudi Arabia
Syria
Tunisia
Turkey
United Arab Emirates
Arab Republic of Yemen
Democratic Republic of Yemen

Sub-Saharan Africa
Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Comoros
Congo
Djibouti
Equatorial Guinea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Ivory Coast
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Niger
Nigeria
Reunion
Rwanda
Sao Tome and Principe
Senegal
Seychelles
Sierra Leone
Somalia
St. Helena
Sudan
Swaziland
Tanzania
Togo
Uganda
Zaire
Zambia
Zimbabwe

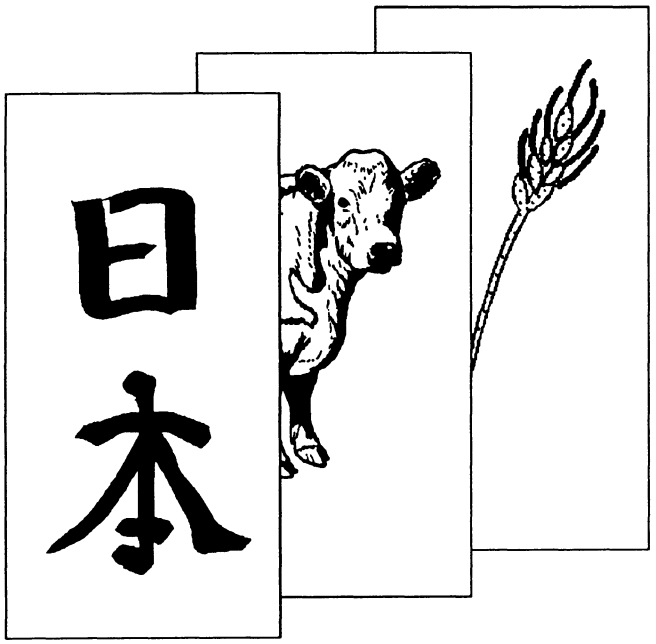
Old Asian Newly Industrialized Countries (NIC's)
Hong Kong
Republic of Korea
Singapore
Taiwan

New Asian NIC's
Malaysia
Thailand

Other Southeast Asia
American Samoa
Brunei
Fiji
French Polynesia
Guam
Indonesia
Kiribati
Macau
New Caledonia
Norfolk Islands
Papua New Guinea
Philippines
Pitcairn Island
Solomon Islands
Tokelau Islands
Tonga
Vanuatu
Wake Island
Wallis and Futuna
Western Samoa

South Asia
Afghanistan
Bangladesh
Bhutan
India
Maldives
Nepal
Pakistan
Sikkim
Sri Lanka

Planned Asia
Kampuchea
Laos
Mongolia
Myanmar
Peoples' Republic of Korea
Peoples' Republic of China
Vietnam



The Japanese Presence in U.S. Agriculture

Japanese investment companies have come to the United States since the late 1980's to purchase, among other things, agricultural land and agribusinesses. How much land? How many businesses? This report gives you the answers and puts those answers in perspective.

Japanese investment in U.S. farmland and agribusiness has grown to over $3 billion, but these holdings represent less than 1 percent of total investment in U.S. agriculture. Japan ranks fourth among the foreign owners of U.S. agricultural land and agribusinesses in terms of value. Investments have been made in cattle ranches and livestock slaughterhouses, citrus groves and other orchards, vineyards, bottled water companies, food processing and beverage companies, bakeries, fisheries, grain storage facilities, restaurants, convenience foodstores, and grocery stores.

International agreements like the 1988 U.S. -Japan Beef and Citrus Understanding have liberalized Japanese imports, presenting both Japanese investors and American growers with opportunities to invest profitably in an expanding market. Foreign direct investment contributes to the growth of employment and income in the host country. (The U.S. Commerce Department defines foreign direct investment as an investment of 10 percent or more in an enterprise.) U.S. policy has generally been to welcome foreign direct investment.

This report determines the types of Japanese investment in U.S. agriculture and agribusiness, puts that investment into perspective in the context of the U.S. economy, determines the reasons for the investment during the late 1980's, and evaluates the impact of this recent phenomenon on the U.S. economy.

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